DOCUMENT RESUME

ED 393 187 EA 027 449

AUTHOR Hough, Herbert William
TITLE Human Nature and Curricula.
PUB DATE 94
NOTE 95p.
PUB TYPE Viewpoints (Opinion/Position Papers, Essays, etc.) (120)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Active Learning; *Curriculum Design; Economics; Elementary Secondary Education; *Learning Theories; Physics

ABSTRACT

This paper is concerned with the development of a coherent unified theory for a science of curriculum--specifically, the development of logical consistency and compatibility with related fields in the formation of theory. Learning as a common human activity is subject to principles germane to human activity in general, as well as to universal principles of action and interaction. These principles of human action and interactive (chaotic) systems, along with understandings about learning itself (planned and unplanned), are used to derive the fundamental theorem of curriculum. Other logical consequences and implications are discussed, attempting to lay the groundwork for a science of curriculum. (Contains 52 references.) (Author/LMI)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

PS

Toward a Unified Field Theory of Curriculum

ED 393 187

Human Nature and Curricula

by Herbert William Hough

State University of New York at Buffalo

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

H. Hough

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC).

Copyright 1994 by Herbert William Hough

EA 027 449

BEST COPY AVAILABLE

Abstract

This paper is concerned with the development of coherent unified theory for establishing a science of curriculum, with the development of logical consistency and compatibility with related fields in the formation of theory. Learning as a common human activity is subject to principles germane to human activity in general, as well as to universal principles of action and interaction. These principles, of human action and interactive (chaotic) systems, along with understandings about learning itself (planned and unplanned), are used to derive the fundamental theorem of curriculum, along with other logical consequences and implications -- in laying groundwork for a science, with much more yet to come.

Human Nature and Curricula

Herbert William Kough

The curriculum field is in some ways a field of dreams, of preferences and pet theories, without any clear focus or definition. It lacks much of the substance of other fields of study. You can pick up most any current or recent book on curriculum theory and find statements along these lines. Goodlad (1979) for example calls it "a field of shifting emphases, often excesses -- . . . disappointingly noncumulative." (p. 19) Ornstein and Hunkins (1988) refer to it as "neither a disciplined body nor a full profession," (p. 11) and that "we cannot agree on the concepts and principles of curriculum, much less on a science of curriculum making." (p. 80) See Jackson (1991, p. 3-4) for more such examples.

Curriculum is a field without acronyms. (1) Newly emerging fields characteristically develop (along with new ideas) new vocabulary and new more explicit terminology, that quickly evolves into shortened streamlined newspeak containing new acronyms. None of this is happening in the curriculum field. For the most part it uses the same old terms that have been bandied about for decades -- evidence in itself that not much is going on.

William Schubert (1984) has noted that a lag has persisted between curriculum and more established disciplines, with existentialism for example influencing

curriculum 50 years after influencing psychology and philosophy. Its methods also lag those of the social sciences, which lag those of the natural sciences. (p. 337-38)

Isn't it about time for the field to assume the stature of a science? There is enough developed science lying around waiting to be applied. We should be using science and logic to help us attain maximum efficiency and effectiveness in the learning process -- to achieve optimal learning. We should be trying to facilitate the most meaningful learning by the most efficient means.

Some in the field have lost faith in science to solve curriculum problems. (Ornstein and Hunkins 1988, p. 80) A.V. Kelly (1989) says that, "Curriculum studies cannot be seen as a science, and especially not as an applied science." (p. 5) But is "theoretically misleading" science really science? He talks of a narrow kind of science -- which is not science of the real world. Likewise, Schwab (1970) discusses theory in the sense of dealing only with ideal cases and abstractions -- which again is not science that deals with real conditions and real people.

The Real World

Most people today have needs and wants that involve getting from one place to another on a regular basis. In spite of this, bus lines and other mass transit systems in big cities always operate at a loss. Even the huge New York

City subway system, with its hundreds of thousands of daily riders, is a perennial loser. And even one-line systems, with far less overhead, in heavily travelled corridors, lose money. Subways of course have immutable routes and station stops (blocks apart) entombed in concrete. Buses are not as fast, but their routes provide more coverage, and they stop more frequently. Yet they also lose money.

Mass transit planners have tried many things over many decades -- more buses, fewer buses, higher fares, lower fares, more routes, fewer routes -- all without success. Yet people have daily transportation needs to be satisfied.

What is it that makes most people opt for their cars, instead of using the cheaper alternative of mass transit?

Is there something fundamental about human nature that causes this?

Video movie rental places have become quite prevalent, with supermarkets and other retail outlets also having their own video rental setups.

There is a strange facet to this. These same movies (more in fact than are available at rental outlets) get shown on TV -- on the same screen used to view the rental movies. A person will spend a couple of dollars or so to rent a movie that might be shown on TV a week or two later.

What is it that makes so many people pay for video rental, instead of viewing what is on TV? Why don't they

just wait for the various movies to show up on TV? Apparently they are willing to pay a price for what they want to watch when they want to watch it.

Bus lines are prescribed courses, but most people prefer their cars. TV programming line-ups are prescribed courses -- but people often opt to pay for video rental. (2) Is there a lesson in this for mass transit planners? Is there a lesson in this, and in mass transit planning, for curriculum planners? They all involve pre-planned sequencing for the masses vs. individual choice.

A bus is really quite similar to a classroom. Each is an enclosed space with seats facing the front, occupied by people who are all being taken in the same direction at the same time.

Transit routes and TV schedules are really curricula -- sequential activities planned by some people for use by others. Many of the same considerations apply to planning in each field.

Mainstreaming the handicapped for example is a concern in schools as well as transit systems (e.g. wheelchair accessibility, signs in Braille). Mainstreaming everyone in fact is the modus operandi in each field.

But why should mainstreaming be the primary or exclusive focus of planning? It is not profitable in mass transit systems -- most people do not choose it. We need to ask how profitable it is in schools. Is it ever seen as an option, or just automatically assumed and used? Educators

do this when they refer to "the curriculum," taking for granted that there should be just one for everyone, and that it should exist as a fixed entity.

"Should there be buses and bus routes?" is the same type of question as "Should there be classrooms and curricula?" (3) But neither question is asked at the planning level. And yet the compatibility of such planning with the natural patterns of human activity has not really been established, in the face of reasons for doubting it. The fact that mass transit and schooling both involve inefficient use of funding is no doubt due in large part to the assumptions they operate under, and not much is likely to change until such assumptions take human nature into account.

One could argue that the routes and schedules of airline companies are really pre-set curricula, and these generally have no trouble attracting passengers. But then they have only limited competition from other forms of transportation, particularly the automobile. (Car rental in fact is quite often combined with air travel -- which provides flexibility and choice that would otherwise be missing from the trip.) And people usually have a specific reason for wanting to go directly from one city to another, but even here most people forgo the lower cost of locked-out options such as with ticket purchase in advance and non-refundable tickets. Also, airlines have to revise schedules as needed and drop or cut back on unprofitable

routes to stay in the black. They also tend to avoid or limit shorter routes that have competition from other forms of transportation.

Passenger trains are a different story. When commercial jets came into use they lost their long-haul business, and when the interstate highway system was built they lost their short-haul business, to buses and cars. And what doomed them was their inflexibility in the face of this. Rail lines are courses that were set decades (perhaps a century) ago, and cannot be changed without a great deal of bother and expense (with new rights of way, new bridges, and maybe new tunnels).

Inter-city buses on the other hand have much greater flexibility to adapt to changing needs, being able to go wherever there are roads, and to stop just about anywhere. This flexibility (along with lower cost) has allowed them to compete with the automobile much more than trains were able to.

And even on the local level, taxis are able to operate profitably, where buses are not. But then taxis do not follow pre-determined routes. They allow the people to determine where they go and when, which they are willing to pay for -- a situation quite similar to video rental vs. scheduled programming.

And likewise with computers. For years the big mainframes kept getting larger and faster, but nonetheless gave way to personal computers (PCs) or microcomputers.

There is a parallel between mainframes and mainstreaming. Mainframes are like buses or trains, PCs like cars and taxis. PCs dominate the information super-highway, just as cars dominate our roads -- and for the same basic reasons. Trying to get car owners to use buses is like trying to get people to switch back to batch processing on mainframes.

The story is the same wherever there are human wants and needs. For instance, you might buy fresh produce or ice cream from a truck if it happens to go by your house and you see it. But if the trucks only stopped at designated intersections at certain times, and if you had to walk a couple of blocks and wait for one to come along, in order to select from their limited offerings, the trucks would not have a chance of competing with the supermarkets. (Shopping carts go up and down supermarket aisles where and when they want, just like cars and taxis do on city streets).

Then too, restaurants are very much like taxis. People are willing to pay for service -- in which they determine what they eat, and when. The successful food establishments do not mainstream their patrons in terms of service.

About the only places where everyone eats the same food at the same time in sequence are military facilities, prisons (in their various forms), and social functions, such as black-tie affairs and dinner with the in-laws. A formal seven-course dinner is a prescribed curriculum. And if too much fuss is made over dinner with friends or relatives, it is apt to come across as inflexibly curricular too -- not

unlike vacation slides or home movies, which resemble pre-set curricula in their sequenced showings, and generally just play to captive audiences.

In just about any area, for any product or service, people are willing to pay for what they want when they want it. And successful businesses operate with this in mind. Wouldn't this also apply in the field of education?

Perhaps the only real issue in all of this is mainstreaming vs. individual choice. All planners, whether in transportation, broadcasting, foods, education, or whatever, need to face this matter of individual choice -- as to whether, and how, it is compatible with their own ideas of prescribed planning (in whatever form) for others. (4)

A Global View

The launch of Sputnik in 1957 sent shock waves through America's schools. But what has happened now, with the Soviet collapse, should send even greater shock waves, and put Sputnik in truer perspective. The implications now are much broader, and the lessons to be learned much more fundamental.

The demise of the Soviet Union reflects directly on the concept of centralized planning and control, the idea of planning and directing other people's lives.

If eastern Europe were thought of as a classroom, a school, you could say that the Soviets got to the point

where they had a real discipline problem on their hands, with all the countries there getting out of line. How should they have restored order? Things went from bad to worse. A while back they tried more discipline, clamping down, in Poland. But that eventually gave way. Hungary and Roumania became just as bad. And the two Germanys were even worse. While the other countries would not stay together in the Soviet bloc, the two Germanys would not stay apart. They were assigned to separate classes, but finally tore down the wall between them, in quite a disruptive act. And then the Baltic states, and even states within the Soviet Union, became increasingly disobedient, defiantly declaring independence -- in effect walking out of the classroom, out of the school.

But even more significant than the political upheaval, is the economic collapse of the Soviet Union. Just as mass transit systems, with their routes and schedules, cannot compete with the private automobile and taxis, central economic planning cannot compete with private enterprise and the free market. (5)

There are many other examples of this besides eastern Europe, in countries with or without central economic planning and regulation, in varying degrees. (6)

Japan and western Europe -- particularly West Germany -- were devastated after World War II. But within 8 years, in a favorable business climate, the economic outputs of these two countries exceeded their pre-war levels, and since

then have gone on to much greater heights.

And more recently, the four Pacific "tigers" -- South Korea, Taiwan, Hong Kong, and Singapore -- have developed booming economies. They all have free-market policies favorable to business. In contrast, the totalitarian rule in Vietnam, in the years since the war there ended, has only produced poverty and economic devastation.

Of course there are the natural comparisons of North vs. South Korea, Taiwan and Hong Kong vs. mainland China, as well as East and West Germany, each of which reveal marked contrasts in prosperity (like a 40-year time warp) -- for these very same reasons. There is no such thing as lock-step progress in a nation's economy.

Kenneth Y. Tomlinson (1991), currently editor-in-chief of Reader's Digest, has said:

> Communism, like other forms of totalitarian collectivism presupposes that man is solely a creature of society, and that Heaven on earth may be achieved through more and better central planning. . . Socialism is based on a false view of human nature, and its institutions stifle the very conditions -- opportunity, creativity, and initiative -- that make it possible for societies to prosper. (p. 1)

It should be noted that even when people do make their

own decisions, if they are hampered in carrying them out by bureaucratic red tape, it is like carrying around excess baggage, and discourages them from acting, even though they are free to.

In this hemisphere, prosperity has mostly eluded Latin America. You might wonder why large populous countries like Brazil and Mexico have not been enjoying prosperity, even compared to other countries with large levels of debt. "What makes the difference is that they are over-bureaucratized, over-taxed, and over-regulated." (Forbes 1991, p. 3) This is the case generally among Third World countries. Says Forbes, "It is not capitalism, but their governments' refusal to adopt a sound currency, low taxes and tariffs, property rights, and minimal bureaucratic interference that condemns Third World nations to poverty, debt and stagnation." Recent reductions in trade barriers and economic regulation have started to make a difference in Mexico. And reforms in Peru and especially Chile are producing dramatic turn-arounds. By contrast, the trend in the U.S. toward increased regulation and taxation has caused it to lose ground to foreign competition.

The School View

There is quite a parallel in all this with education. Successful nations have a lot in common with successful learning environments. In each case, economics and education, the key is how free people are to pursue their

own interests. "Innovation and productivity do not flourish under the centrally controlled system." That statement by Tomlinson (1991, p. 2) applies to schools as well as to nations. With nations it involves entrepeneurs being free to develop their interests and explore possibilities. With schools and learning it involves students also being free to develop their interests and explore possibilities. How much learning goes on in teacher-dominated classrooms, or where students are burdened with busywork that acts as a dead weight on the free spirit of learning?

Nations as well as schools and classrooms suffer when they are over-bureaucratized and over-regulated, and when central pre-planning prevents the pursuit of private interests. Friedrich A. Hayek (1960) said that

> we must recognize that . . . it is more important to clear away the obstacles with which human folly has encumbered our path and to release the creative energy of individuals than to devise further machinery for "guiding" and "directing" them -- to create conditions favorable to progress than to "plan progress." (p. 239)

For schools, read "achievement" in place of "progress."

John Dewey (1975) made a similar comment in regard to creating favorable conditions in education:

> The doctrine of interest . . . . is a warning to furnish conditions such that the natural impulses and acquired habits . . . shall obtain subject matter and modes of skill in order to develop to their natural ends of achievement and efficiency. Interest . . . is the inevitable result of the presence of such situations. . . . If we can discover a child's urgent needs and powers, and if we can supply an environment of materials, appliances, and resources . . . we shall not have to think about interest. It will take care of itself. (p. 95-96)

Whatever impedes the pursuit of private interests lowers the standard of living in nations and the standard of learning in schools.

Why should there be a parallel between economics and learning, in terms of principles of action? Because the same processes are involved in each. A person wants to engage in an activity for some purpose. There may be a profit motive behind it, or the motive may be to gain knowledge -- or even more generally, just some benefit to the person who decides on the activity. Whatever the purpose, the principles guiding the action are basically the same.

Learning is not an isolated and unique activity, in terms of the factors and principles that affect it. Thus

curriculum theory, if it is valid, should have broad applicability, to other human activities besides learning (i.e. learning should be only one of the areas in which it is applicable and useful) -- particularly as learning is often an incidental aspect, to a greater or lesser extent, of other human activities.

Sometimes activities are engaged in specifically to learn something, but often they are not. That does not mean that there are two different sets of guiding principles, depending on intent -- like two different laws of gravity. The same basic principles apply in each case.

Ludwig von Mises came to realize this same sort of thing in the case of economics. In his monumental work Human Action (1966) he refers to the fallacy of making a distinction between the "economic" and "noneconomic" spheres of human life, as if they were entirely separated from one another (p. 285), and states that:

> In studying interpersonal exchange . . . . it is no longer possible to define neatly the boundaries between the kind of action which is the proper field of economic science in the narrower sense, and other action. Economics widens its horizon and turns into a general science of all and every human action . . . (p. 232)

This science of all human action, known as praxeology, would

of course include education.

Free-market economies (although none are completely free) always in the long run beat planned, regulated economies -- as comparisons among nations show. How do free-learning environments stack up against planned, regulated learning?

The contrast is more apparent among nations, since total economic activity can be determined by such measures as the gross national product (GNP). (7) Total student learning is more difficult to measure since much of it, including the most significant learnings, is internal and cannot be readily gauged or measured. (8)

And thus the myth that economic activity can be successfully planned and regulated, that such planning can compete with free markets, should shed light on the matter of how successfully learning can be planned and regulated, compared to free-learning environments.

The Fundamental Theorem

The key distinction, the key factor, is whether or not people have an active role in what affects them. And in the case of learning, a curriculum theorem can be quite simply stated:

> The concept of curriculum, as a pre-determined learning sequence, of what students are to learn and when, is only valid (for maximum effectiveness

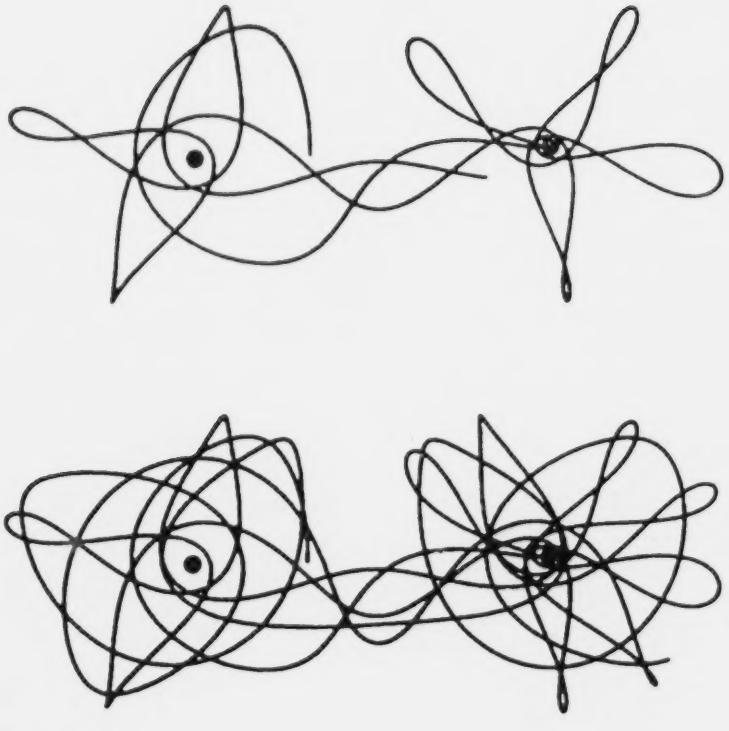
> and efficiency) if learning is inherently passive, with students acting as dormant depositories to which planned learning is to be imparted. As soon as learners act as active agents in their own learning, this concept of a pre-determined sequence, of what they will learn and when, is no longer valid.

It follows that in learning, as in other human activities, using pre-planned sequencing to direct activity does not work as well as the alternative. The parallel with economics, in the different levels of achievement among nations, clearly shows this to be the case. If each person is an active agent in a nation's economy, free to choose transportation, entertainment, food, and so forth, as well as which activities to engage in, you have an interactive system far too complex to be successfully matched through central planning, no matter what models and how much computing power is used.

There is a famous unsolved problem in physics, that seems deceptively simple to state. The problem is to come up with equations of motion for three bodies in space acting under gravity, in terms of their masses and their initial positions and velocities.

These equations of motion are like curricula -- they enable you to tell where each body should be at any given time in the future.

Figure 1



It is not all that difficult to express the gravitational attraction in terms of differential equations to be solved for the actual motion -- but they will be unsolvable. (9) Figure 1 (Peitgen and Richter 1986, p. 2) shows the chaotic motion at two different points in time of a small planet around two suns. Even in such a simplistic system (simpler than reality since stars are not fixed in space) the orbit, the course of the small body, is far too complex to determine or make useful predictions about.

However, if one of the three bodies is so massive (the sun for instance) that the other two have virtually no effect on the system, then they are solvable -- the non-dominant bodies will merely be directed in predictable orbits by the dominant one.

Compare that to three bodies in a classroom. Which situation is more complex -- learners with curiosity and all kinds of potential questions, or inert bodies whose only interaction is gravitational?

Of course, if one of the bodies (the teacher) is so dominant that the other two merely respond passively to directives, then you can operate with a pre-determined curriculum, and can predict where the two of them will be at any given time.

When we urge our students to seize the day (carpe diem), we violate this passive type-cast. And in doing so, we undermine the whole basis for a predictable pre-determined curriculum.

Figure 2

"When the bell rings, come out fighting. Land a couple of lefts to the jaw in rapid succession, back off, dance around a bit, then come in suddenly with a right hook to the ear, then a left, then a right, clinch, back off and feint with a left, feint again, then come in with a right jab to the body and then a left to the body, clinch, back off and dance around for a bit again, then suddenly come in with a long left uppercut . . ."

Weber (1963)

Reprinted by permission of the New Yorker magazine.

BEST COPY AVAILABLE

In a truly interactive system -- even with just two people interacting -- whether at lunch, in a boxing ring, or wherever, there is very little that can be predicted or predetermined, especially after the first few moments. Whether they exchange punches, or ideas, the situation is essentially the same in this regard -- and is even more hopeless than with bodies in space. Can active students travel predictably through a spiral curriculum the way planets travel predictably in their orbits? And what if, instead of three bodies in a classroom, you have 30?

In reality, attempts at planned and regulated learning go far beyond this, involving thousands of bodies throughout a city or state. How can this possibly work with active learners and all the interactive systems and sub-systems involved? It is as futile as trying to plan and run a nation's economy. Such uniform curricular planning implicitly regards students as passive objects in their own learning.

Adam Smith (1982), in his first book, captured this sense of the impossible task facing the planner, who is apt to plan anyway, in a state of self-delusion:

> The man of system . . . is apt to be very wise in his own conceit; and is often so enamoured with the supposed beauty of his own ideal plan of government that he cannot suffer the smallest deviation from any part of it. He goes on to

> establish it completely in all its parts. . . . He seems to imagine that he can arrange the different members of a great society with as much ease as the hand arranges the different pieces upon a chess-board. He does not consider that the pieces upon the chess-board have no other principle of motion besides that which the hand impresses upon them; but that, in the great chess-board of human society, every single piece has a principle of motion of its own, altogether different from that which the legislature might chuse to impress upon it. If those two principles coincide and act in the same direction, the game of human society will go on easily and harmoniously, and is very likely to be happy and successful. If they are opposite or different, the game will go on miserably, and the society must be at all times in the highest degree of disorder. (p. 233-34)

People are not passive pieces on a chessboard, and no single central plan can possibly be in harmony very long with all the varied motions of the different pieces.

Chaos and the Classroom

In describing the operating forces that lead to alternate states of harmony and chaos, Adam Smith sounds like a prophet of the new science of chaos, two centuries

before it developed.

This new science, which is concerned with interactive systems, has been dealing with complexity in a variety of different and unrelated fields. (10) The teacher-student relationship is a complex interaction (if the teacher does not simply control everything). And so a lot of what has been developed in chaos is applicable to curriculum and to learning environments.

Chaos applies directly to the flow of fluids -- and thus to curriculum. The idea of curriculum as a mainstream, as a course or direction of movement, comes right from fluid mechanics. In textbook examples, fluids behave in nice linear mainstream fashion -- but this is not often the case in the real world. It does not take much to bring an onset of turbulence, of chaos -- which acts to undermine the whole mainstream flow. And so this too has a strong bearing on the theoretical basis of curriculum.

Chaos really got its start with the "weather machine" experiments of Edward Lorenz in the early 1960's. It was rather simplistic as a weather machine -- really just an electronic computer being used to calculate incremental changes in the variables from several differential equations selected to represent the weather system.

One day Lorenz decided to repeat part of a previous run. He used mid-course values from his earlier run as the starting point for his current run, rounding them off to 3 decimal places. He found, however, that the overlapping

portions of the runs agreed only briefly, diverging rapidly to where there was no longer any similarity between the two. He saw that what caused this was the seemingly insignificant portion of the input that he had rounded off.

This was subsequently tried on two different supercomputers to about 50 decimal places of accuracy -- and the same thing happened. "If they were computing the weather, then one would be telling you there's a heat wave coming and the other would be predicting a blizzard." (Stewart 1989, p. 287)

This same characteristic has since been recognized in other phenomena, and has been given a name -- sensitive dependence on initial conditions. It has also been referred to as the butterfly effect, the idea being that the "insignificant" action of a butterfly flapping its wings could lead eventually to a violent storm somewhere.

In the case of people, and butterflies -- and free will in general -- a more appropriate designation might be "sensitive dependence on intermediate or immediate (rather than initial) conditions". (The butterfly could flap its wings at any time.) In either case the acronym SDIC can apply.

SDIC is linked with the fundamental fact of non-predictability in interactive systems, which could be as simple as three bodies in space. (The fundamental theorem of curriculum is really the fundamental fact of chaos.)

Also associated with chaotic motion and

non-predictability are states known as strange attractors. In physical systems these can sometimes be identified, but in a classroom of active kids filled with curiosity, the situation would be hopeless. There are surely strange attractors in any classroom, strange at least in the eyes of the teacher. They lurk as unsuspecting traps for inflexible teachers. No doubt they are embedded in the hidden curriculum, which is surely a turbulent and chaotic domain.

In systems where differential equations expressing the ongoing changes can be written, they are in almost all cases non-linear in nature, and thus generally unsolvable. And in the real world the equations usually cannot even be written.

Lorenz came to realize, from his "weather machine" experiments, that no matter how powerful our computers become in the future, or how sophisticated our weather instruments become, we will never ever be able to reliably predict the weather more than a few days in advance.

T. J. Cartwright (1991), in his article "Planning and Chaos Theory," cites an even more graphic example -- that of trying to predict a cue ball's path after it strikes the collection of balls on a perfectly shaped frictionless billiard table:

> "If the player ignored an effect even as miniscule as the gravitational attraction of an electron at the edge of the galaxy, the prediction would have

> been wrong after [only] one minute!" (Crutchfield et al. 1986) What hope have we of making anything but the most approximate forecasts of far more complex phenomena like housing or traffic flows five or ten years hence? (Cartwright 1991 p. 55)

And what hope have we in education, with our crude measurements that do not even measure real meaningful learning?

If we will never be able to plan for the weather more than a few days in advance, or a cue ball even a minute in advance -- in systems whose components have no intelligence at all -- how can we possibly plan for dozens or thousands of students, a semester or a year in advance -- when we are not even close to the state of the art in these other fields?

Chronos, Kairos, and Chaos

There is a place though, where the weather was predictable and had none of this complexity -- Camelot. Some lines in the first act of the Lerner and Loewe production (1960) describe the situation there:

> A law was made a distant moon ago here,
> July and August cannot be too hot;
> And there's a legal limit to the snow here
> In Camelot.

The winter is forbidden till December,
And exits March the second on the dot.
By order summer lingers through September
In Camelot. (p. 14)

Apparently there were no butterflies to affect Camelot's weather. They not only predicted the weather there -- they ran it.

But we are not in Camelot. We are dealing with students and learning in the real world.

In the Greek language there are two words for time -- chronos and kairos. Chronos represents chronological time, the kind that progresses in a steady linear fashion, that we reckon with clocks and calendars.

Kairos, on the other hand, is not time in a linear sense, but in a sense of the right moment for something, an opportune time, a readiness for something depending on what the conditions are, such as the time to plant, or the time to talk. SDIC is often involved in these cases. The book of Ecclesiastes in the Bible has this sense of time too -- "a time to be born, a time to die . . ." Obstetricians and midwives do not have appointment calendars for deliveries. They perform their services when the time is right.

Kairos is the time of chaos, of interactive systems. It is the time of our lives, as Ecclesiastes brings out. It

is the time we are born by, and grow by, and learn by, and die by.

Curricula, on the other hand, (the kind used in schools, and in Camelot) are very much chronos-based. They are linear in nature, whereas life and learning are not.

A child's entry into the world -- where essentially just physical factors are involved -- is kairos-based. Yet for his education -- where physical and intellectual and emotional factors are all involved -- he is likely to be locked into a chronos-based curriculum when schooling begins. But the way children grow, the stages of maturing, their mental readiness, are all kairos-based, different for each child. How appropriate then is uniform forced scheduling of educational development?

Non-linear Differential Equations for Parents and Party Planners

Interactive-ness and non-linearity go hand in hand. That needs to be recognized. With interactive-ness it results in unpredictability; with non-linearity it results unsolvability, which is really the same thing, since a solution would allow you to tell the future states of the system.

Suppose that somehow you got possession of differential equations that express how a particular (non-linear) real-world system changes in ongoing fashion from moment to moment. The interactions within the system would no doubt

show up as intractible cross-terms in the differential equations, making them unsolvable. All you would be able to get at best is glimpses of how the system changes in time, without knowing the actual state of the system itself.

Often such interactive systems reflect back on themselves, in a kind of circular recursion. Change is self-generating, sometimes having a snowballing (or butterfly) effect. The ingredients for change are all or mostly within the system itself. The system simply reacts to itself, to produce ongoing changes.

If you point a TV camera at the screen that shows what it sees, showing only this screen, you get the same effect, of a system reacting to itself, almost like a weather system. And what happens will be unpredictable.

This applies to social gatherings as well. The people attending an affair react to each other in ongoing fashion, with subgroups forming and re-forming, and conversational trends developing and dissipating, all in unpredictable fashion -- which is to say that the group reacts to itself, unless the host has everything planned in advance.

Self-actualization has this kind of self-determining quality. Parents who try to run their children's lives, steering them in the "right" direction cannot make it happen -- they run into too much SDIC. (Raising kids is not an elevation activity performed on passive objects.) To paraphrase Hayek (see p. 13), you cannot teach self-actualization -- you can only create conditions

favorable to its development.

Carl Rogers, who became an advocate of non-directive teaching, realized all this and put it into practice. A student (Tenenbaum 1969) tells about one such course he was part of. As the course started, the students looked at the professor expectantly, with their notebooks ready, and he merely smiled and looked back at them, in mirror-like fashion. ("We all looked to Rogers and Rogers looked to us.") As group discussion got going though, amid initial complaints, the group determined its own direction -- just by reacting to itself -- with results that were reportedly unique, special, and overwhelming.

In contrast to what goes on all around us, our curricula for schools are overwhelmingly linear by nature, laid out as pre-determined sequences to be followed by all. The whole concept of curriculum is permeated with a penchant for linearity. Even spiral curricula are linear, in terms of their path parameter, in the way they are used.

Kid Jackson's manager (see Figure 2) does not seem to realize that he is in an interactive situation. (Was he formerly a curriculum specialist?) His planned sequence of action shows a complete disregard for the opponent's activities, reactions, and tactics, that he might be throwing punches of his own. Just as you cannot afford to ignore an opponent's punches in the ring, you cannot afford to ignore student questions and attitudes in the classroom.

Kid Jackson is getting a linear sequence of

instructions from his manager -- that will not help him at all in the interactive situation he is faced with. Yet how often do teachers do essentially the same thing, trying to follow a set curriculum or lesson plan when the butterfly effect is rampant in a class of active kids.

There is the story of the chess master who was so confident of his ability that he mailed in his whole sequence of moves for any given match ahead of time, and had someone vicariously carry them out when it was actually played. If that sounds dumb, how about curriculum developers who mail out curricula to schools in their districts ahead of time, to be vicariously carried out, or who sell them through catalogs and other means?

Like Kid Jackson's manager, we persist in sticking to the linear sequences of our curricula, in a world of non-linearity.

Learning Objectives

Chaos and SDIC also impact on the concept of learning objectives. Their use involves stating the conditions under which the demonstration of learning is to occur. Robert Mager (1962), who developed his own approach to learning objectives, refers to "describing the important conditions under which the behavior will be expected to occur." (p. 12) But because of SDIC we cannot really tell which conditions are apt to be important.

Kibler, Cegala, Barker, and Miles (1974) go further in

regard to specifying conditions: "List as many of the actual conditions as possible under which the student might be expected to demonstrate the terminal behavior in a real-life setting. . ." (p. 38) A real-life setting would of course involve chaos.

But even this is not enough. Beyond this there are conditions we are not even aware of that could affect behavior. And even those we can think of cannot be determined with anything approaching precision. Recall that attempts at repeat weather-machine runs failed to reproduce earlier runs, despite miniscule differences in input. Even if the earth were blanketed with weather stations that could accurately determine ambient temperatures to many decimal places, that would still be insufficient for reliably predicting the weather. And if we cannot ignore electrons at the edge of the galaxy, as with billiard balls, we cannot ignore anything.

The Gagne and Briggs model, developed as an alternative to Mager's, refers to "circumstances" as well as "tools and other constraints" (Briggs 1977, p. 68) but does not really deal with the matter of imprecision and inadequacy regarding stated conditions. SDIC is never dealt with, or even recognized.

Also, all of these models explicitly treat learners as passive entities ("Given a hammer and saw . . .", "Given a list of factors . . .", and so forth) -- as sort of passive black boxes, with input (the givens) and output (the

demonstrated learnings). If, instead, objectives were to be stated in terms like "obtaining whatever resources he or she deems necessary and/or useful, the student will . . .", they would lose their predictability and repeatability. They are only applicable to passive students in controlled environments (non-interactive systems) -- like classrooms and Camelot. None of this really applies to active learners in real-life situations.

SDIC also means that different students will learn different things from the seemingly same experiences, because the conditions (internal and external) will be different in each case. Therefore there cannot be learning objectives that apply uniformly to all students in a group or a class.

The movie The Boys from Brazil (Richard, O'Toole, and Schaffner, 1978) is based on a diabolical plan to spawn new Hitlers by placing genetic reproductions of him with foster parents, then replicating the conditions of his childhood -- a sort of raising kids by curriculum, complete with learning objectives. But to think that such a scheme would even come close to working is utterly preposterous, in view of SDIC -- Lorenz could not even do that with his simple weather machine. How can you measure and record the meaningful parameters of a person's life, in all their particulars, for reliable replication -- after the fact at that? You cannot even do that for your own life. Yet how many curricula are sold or passed on to prospective users with the idea that

the conditions envisioned can be replicated in others?

Another thing about learning objectives is that they treat particular learnings as singularities, as discrete elements that can be isolated -- whereas a more realistic picture in many cases might be a continuum, a large nebulous essentially continuous cluster of learnings, clustered around a particular interest or type of experience. This introduces uncertainty into the picture for individual learnings, like having an electron cloud of probability rather than a discrete charge at a particular point. And in a large cluster, individual learnings (like individual stars in a galaxy) may not even be discernible or definable, and even if they are, not really significant. Overall impressions of people, and things in general, are like this. Defining learning objectives in such cases becomes a game of trivial pursuit. An uncertainty principle (comparable to Heisenberg's in physics) needs to be recognized for individual learnings -- along with the unpredictability of the interactive systems they are part of.

Motivation

Also affected by chaos is classroom motivation. Because of SDIC, there is no telling where it might lead. You are playing with butterflies when you attempt to motivate. The varied reactions could produce waves of interest that would play themselves out in some

unpredictable and unplanned ways -- unless they are suppressed or checked.

The irony is that motivation is only needed because intrinsic motivation and natural curiosity are suppressed in the first place.

A parallel irony is that state and county governments, spend tax money on industrial development agencies (IDAs), job development programs, and the like, in trying to attract businesses to their locales -- in the midst of regulations and high taxes that drive businesses away in the first place. They would do better dropping the IDAs and other programs, and just cutting the taxes and red tape.

And so motivation is attempted in a medium (the school with its locked-in schedules and rules) that tends to demotivate -- a prime recipe for turbulence, if it is at all successful.

But in attempting to motivate, the teacher usually has his or her own ulterior motives. Classroom motivation does not just mean trying to make something interesting -- anyone telling a story or joke does that. There is often a sense of sugar-coating something you want the students to swallow, or to steer them in that direction.

But motivation is a poor steering device. When you start a fire or make waves, you do not know how it will spread, what it will lead to. Real motivation in a free environment can be dangerous, if you have prior plans. You cannot really steer students in some pre-conceived direction

this way -- the bait-and-switch tactic does not always play out as planned.

In one literature class I observed, the teacher showed the students some photos of atomic bomb damage in Japan, as a way of getting them interested in reading a related play taking place in Japan. One boy could not accept what the teacher had told them, saying, "One bomb didn't do all that!" He was clearly ready for more material on the subject, but for some reason he did not wander off to the school library. And while some other students may have had similar reactions, the class was clearly not together (on the same wave) as a result of this motivation. Right there was the beginning of a bifurcation (onset of chaos). And in spite of it, the teacher still had to get the students somewhat awkardly into reading the play. It was not a smooth transition.

A wave of interest determines its own path intrinsically. You can influence it, due to SDIC, but you cannot tell where it will go.

Prime Time

In education there is a kind of romantic imagery attached to the concept of "the teachable moment," of taking advantage of it when it occurs.

The term, however is not really well defined -- it is not even a standard ERIC descriptor, nor is there any reference from it to one. And it is mentioned more often

than it is actually discussed. Generally though, it tends to be applied to cases where at some point, for some reason, a student is ready and reachable.

But then it is apt to turn into a preachable moment. A teacher may sense a teachable moment only when a student drifts dangerously close to something in the prescribed curriculum. In the same way, a neighbor who sells encyclopedias might be looking for a sellable moment, or a party host for a showable moment (for home movies), if conversation happens to drift in the right direction.

But if the focus is really on the student, why doesn't any question or request for information or help become a teachable moment? Whose needs are really being addressed?

"The teachable moment" never (or hardly ever) appears in books on curriculum and teaching methods. This might seem odd, but there is a very good reason for it. The teachable moment is a phenomenon of kairos time, whereas curricula (the kind discussed in textbooks) have a linear basis in chronos time. You cannot really discuss capturing a teachable moment without getting away from a sense of chronos time and of following a pre-set schedule -- and certainly not for any imaginings about maximizing such a moment. Also, due to SDIC, different students are apt to have different teachable moments, at different times -- although there are times when such a moment can involve nearly everyone in a group. But even these cannot be planned for. They may be due to unexpected happenings or

reactions. And since the unexpected is not part of a pre-planned curriculum, it is not discussed in this context, and thus probably not at all.

Why is the term typically rendered singular, as if it represents something unique? Does it mean that most of the time students are not teachable or reachable? Does it represent a momentary opening that the teacher needs to be ready for -- like a boxer waiting for the hittable moment? (What assumptions are being made regarding the student?) In real cooperative ventures there are more than just moments in which fruitful collaboration occurs.

John Dewey (1975) likewise argued against mere momentary excitations of interest, calling them "averse to sustained thought and endeavor," and saying that, "It is not enough to <u>catch</u> attention; it must be <u>held</u>" (p. 91) -- without saying though who does the catching and holding. (11)

On the other hand can we afford to ignore the sense of moment, as expanded points of kairos time filled with curiosity, urgency, or wonder? We would need to recognize such moments in thinking about maximizing each moment of time in a learning experience. Such moments do not become static unless they are impeded. We need to allow them to flow fully and freely, with the strongest sense of next-ness -- like seeking the maximum slope on a hill or a wave, achieving maximum flow, finding the maximum differential from moment to moment. (How can teachers possibly detect

such fleeting differentials in students, though? They cannot even detect the question-mark balloons over students' heads when they occur.)

In spite of all this ambiguity then, "teachable moment" does recognize that readiness (present readiness, at any given moment) is a prerequisite for real learning -- and as such can be useful, although what we really need is new terminology.

Optimal Curriculum

An optimal curriculum then could be defined tentatively as one which correlates with a maximum density of teachable and near-teachable moments during experiences that involve learning. (12)

There are a number of things that can be deduced from this. Since it is widely recognized that students learn something best when they are ready for it, it follows that maximum readiness should be a major concern for curriculum. In a way, this is like saying that maximum readiness should be a major concern of obstetricians, when delivering babies. Of course you could have obstetricians that favor the extraction method of delivery ("ready or not, here you come"). And if the state department of health had clinics that performed free deliveries in every community, they might be apt to use this method -- even though studies might show that births work best when delivery assistance is matched with maximum readiness, as determined by Mother

Nature.

And since maximum readiness, for any particular topic or area of learning, would not be the same for every student (due to internal and external SDIC), it follows that the optimal curriculum would be different for each student -- although there would no doubt be common ground at times.

Tracking the Mind

The time factor is another consideration -- a curriculum by nature involves a time interval rather than just a single moment. Maximum readiness therefore means attempting to match a whole succession of moments to the learner. And thus sequencing becomes critical -- involving no less than anticipating, at each point in time, the ongoing thoughts of each student, their probable succession of thoughts. Could you manage to arrange a learning environment with the required infinite perception and foresight for this to happen? Could you even manage to track someone's thoughts as a real-time observer, or write a textbook in real time while reading a student's mind?

Near the beginning of "Murders in the Rue Morgue," the author Poe (1966) tells of being astounded during an evening stroll, when his friend Dupin expresses agreement with what Poe is thinking -- 15 minutes after the last conversation between them. Dupin explains by describing Poe's chain of thoughts from having stepped on a loose paving stone 15 minutes earlier, and that (in tracking Poe's thoughts) he

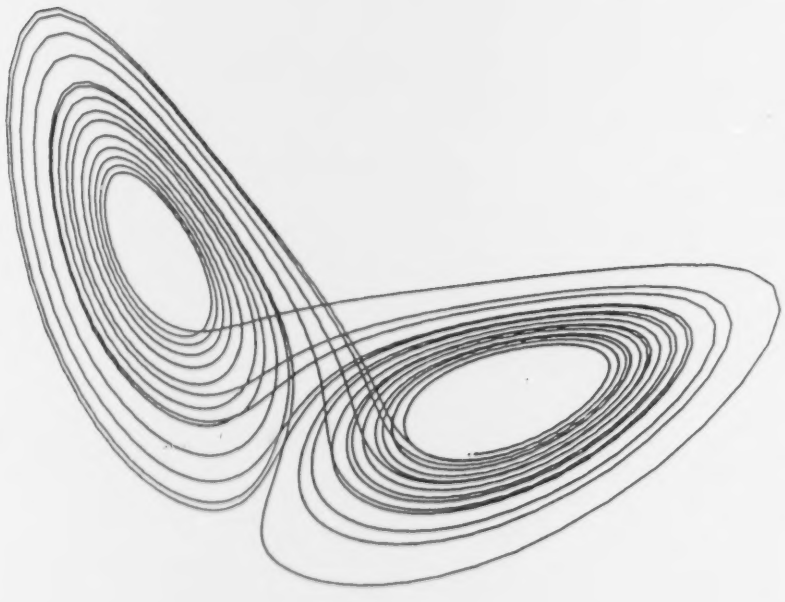
used such reliability checks as Poe's sustained downward look, a movement of the lips, a look upward to the sky, a smile, and a straightening of his posture. (p. 5-7)

In view of SDIC, and the rather tenuous nature of the cues picked up on, Dupin would have been extremely lucky to have successfully tracked Poe's actual thoughts. In general, with all the little things (internal and external) that could significantly affect one's sequence of thoughts in reflective thinking, the chances of someone else being able to silently track them are practically nil.

The task facing someone who would develop an optimal curriculum, trying to do thought-matching for even just 15 minutes for a particular student, is much worse than this, having to do it blind, with no visual or verbal cues -- and not just for one student, but for hundreds or thousands. It goes without saying that he or she will not develop the optimal curriculum for each student, or for any one of them. (There are, however, ways for capturing someone's attention for 15 minutes, or even longer. But this too has limitations.)

If an optimal curriculum exists, then in theory there would be differential equations (even though too fragile and complex to ever find) that would express how this curriculum moves along from one moment to the next, how it is sequenced. This would require reading each student's mind thoroughly and with extreme precision, without in any way disturbing it -- even the slightest disturbance in doing

Figure 3



this would alter the equations and the optimal curriculum sought.

A rather simplistic example that nevertheless shows how differential equations behave in this regard is shown in Figure 3. This is a two-dimensional projection plotted by Lorenz from a set of three differential equations -- even simpler than the set he used for his weather machine, but nevertheless still unsolvable. (13)

In this example, known as the Lorenz attractor, there are two attractor basins which the path travelled shifts back and forth between in unpredictable chaotic fashion. There is no telling when it is about to flip back over to the other side.

Now imagine that this represents a curriculum, with just two topics. Even though it is simplistic, it is much closer to the real world than the spiral curriculum, which it resembles. The spiral curriculum involves returning to particular topics for greater coverage at regular planned intervals, at each succeeding grade level -- sort of like the legislated weather in Camelot.

The Lorenz "curriculum," on the other hand, returns to the other topic at irregular intervals, only when the time (kairos) is right -- which for even such a simple system cannot be determined in advance -- and in reality, due to SDIC, would be different for each student.

In real life of course there are many more than just two topics of potential interest (some of which are

interrelated, besides) making the problem of organization much more complex, and in fact impossible.

The Matter of Sequence

Curriculum specialists for a long time have recognized sequencing of learning experiences as a difficult problem, which according to Taba (1962, p. 291) they have not done much about, or even addressed to any extent. Ornstein and Hunkins considered Taba's assessment still valid as of 1988, saying, "this failure to pay serious attention to sequence in terms of the cumulative development of intellectual and affective processes has resulted in less than optimal curricula . . ." (p. 169)

But sequencing can be either difficult or not really much of a problem at all, depending on how you look at it.

If, in taking a trip, I successfully drive my car into a garage 500 miles away, the accuracy involved in this act could be considered truly astounding. It involves an error of a foot or less on either side, and from a distance of 500 miles that represents a tolerance angle of only .00004 degrees.

But that is not all. I also get to the garage over a very specific path, from which the car never strays more than a few feet during the whole length of the trip! And I do this in spite of possible high winds and other conditions along the way. Wow!

On the other hand, it is no big deal really, if you

consider one other factor -- real-time decision making.

Kid Jackson's manager (see Figure 2) evidently does not believe in this, and as a result has a real problem -- the same problem that curriculum makers face.

Taba (1962), in devoting a whole chapter to the problem, says that in typical curriculum materials, "The principles of sequence (for learning experiences) are usually suggested only in very general terms" and that "Relatively little guidance is given." (p. 291-92) In reality then there are no teacher-proof (or student-proof) curricula, just as there are no driver-proof trips. You cannot bypass real-time decision making.

But there is another aspect to the difficulty seen in sequencing. Taba (1962) says that the problem "requires an application of all we know about the nature of knowledge, about child growth and development, and about learning." (p. 290)

To people with such worries about sequencing, I would suggest going to see some Hollywood movies, such as ones by Hitchcock (who was a master of suspense, and had a knack of timing) -- but also any other number of films, as well as books, by good storytellers. And if the concern is specifically about children there are the Disney films, particularly the educational ones.

There have also been notable films and mini-series centered around actual historical events, like the Civil War and World War II. These too could be studied for technique,

and compared with curriculum and textbook treatment.

Taba is concerned about continuity in sequencing, but in many notable stories and movies there are major jump discontinuities -- the flash-back, the ranch-back ("meanwhile back at the"), the jump forward (sometimes by several years), and other segments with unconnected endings and beginnings. So continuity (in the topical or chronological sense at least) does not seem to matter. People are used to jump discontinuities. They are part of the real world of phone calls, commercial breaks, and channel switching.

How would you rate the sequencing of events in a story like A Tale of Two Cities, where the action jumps back and forth between France and England before and during the French Revolution? Could it have been done better? How would curriculum experts improve upon it?

As an exercize, try to reconstruct from memory the order of events as they occurred in the story, or in any story or movie that made an impression on you.

Then ask yourself -- How does the story's impact on you depend on your ability to do this? Is the impact small at first, until you start recalling the sequence, or is the impact something you immediately recall. Maybe you had several of the episodes in the wrong order. Was the story's impact less because of the way you filed these in your mind?

Another example is the movie Annie Hall, (Joffe and Allen 1977). This comes across as a bunch of episodes

strung together in a seemingly haphazard fashion. Yet the movie had a strong impact on a lot of people, including movie critics and the Oscar people (Best Picture, 1977). (14)

Film critic Roger Ebert (1988) says of another movie The Deer Hunter (Peverall and Cimino, 1978), about how the Vietnam War affects the lives of several people, "It is one of the most emotionally shattering films ever made." (p. 78) Much of its impact is due to character development, and to powerful evocative scenes that have an interplay of different themes -- a characteristic of powerful images, both in photographs and paintings. Ebert says that the movie "gathers you up, it takes you along, it doesn't let up." (p. 80) Why couldn't school curricula could do that?

There are a couple of things that are worth noting in all of this.

One is that sequencing is not always of utmost importance. What really matters is whether or not the material engages the mind. If it does that, then sequencing just needs to avoid getting in the way. It just needs to be adequate enough to serve as a vehicle.

This suggests that maybe curriculum makers in their planning, should be more concerned with material having impact, that engages the mind, than with the matter of sequence.

The sequencing problem, as generally conceived, seems

to assume that the material being sequenced is not something that will turn students on (rather like a party host trying to sequence home movies to minimize the negative reaction). But in that case sequencing is not the real problem, and trying to treat it as such, when it isn't, makes sequencing seem quite difficult indeed.

The seeming difficulty is the same as that of trying to drive someone else's car, from the outside, with only partial control of the vehicle. It is much better to let each person drive his own car, and push his own shopping cart.

Prime Timing

A curriculum theory which claims to be comprehensive would need to consider time as a praxeological factor, not only in sequencing an activity, but for initiating it in the first place.

When I was an undergraduate majoring in physics I was advised to take Scientific German -- because I might have use for it some day. That day has not come yet, and in the meantime I have forgotten nearly all that I learned in that course. So in terms of economics (efficient action) it was a waste of time and money, on two counts -- I never had a need for what I learned, and what I learned I forgot. It was like excess baggage that leaked. (What is the shelf life of such courses?) If I were to develop a need for it now, the course I took back then would be useless -- a case

of bad timing. Of course this was not the only instance of this sort of thing.

On the other hand, I have picked up several dozen Greek words (which I remember) just from my own reading and studying -- without embarking on any program to learn Greek. Why couldn't the same thing have happened with Scientific German, if I had developed a need for it. I would have learned what I needed at the time I needed it.

Circumstantial readiness (what I need when I need it) should have far greater weight than mental development, in determining when something can best be learned. In fact the former really implies the latter.

Any curriculum theory that does not take these aspects of time and timing into account is really incomplete.

The Logical Implications

So then where does all this leave us in terms of trying to develop optimal curricula, optimal sequences of learning activities? For one thing, it leaves us with real-time decision making, by the driver of each car.

But this will result in the cars going in all different directions (just like the real world -- would we rather be in Camelot?) Cartwright (1991) says that, "we must learn to rethink some of our deep-rooted beliefs in the virtues of order and predictability . . . . that a chaotic city, for instance, may be preferable to and 'healthier' than an orderly one." (p. 54) This could also be applied to

classrooms. (15)

And yet an absorbing story or movie tends to have an opposite effect, to counter such chaos, in the way it sweeps everyone up in its flow of action.

But Alfred Hitchcock will only grab my attention like this for a couple of hours or so. (For longer times even he needs an intermission to keep holding my attention.) What will happen after that? I might rent another Hitchcock movie, or I might want to find out more about birds, or psychosis. There is no telling where it will lead, although I do know that it will play itself out.

And if I read A Tale of Two Cities I might go on to other Dickens stories, or I might want to see the movie, or it might lead me into learning more about the French Revolution. Who knows? That is where the butterfly effect comes in. If a lot of people read A Tale of Two Cities, they will head in a lot of different directions -- if they make their own decisions regarding their interests -- that is, if they do their own driving, instead of being stuck on a bus so that they all head in the same direction at the same time.

And in my own case I could choose to pursue both Hitchcock and Dickens, and both of these would lead to subsequent choices. When I go to video rental places I usually get more than one video. I also go to the library. As a result, I might be riding several waves at the same time, jumping (discontinuously) from one wave to another,

hitting a lot of "teachable moments" along the way.

I also become aware that I am making waves, generating or at least sustaining each wave that I ride. Sometimes a ride is fairly long, sometimes short. In either case it is usually rapid -- an example of self-perpetuated crash learning (SPCL), about which little has been written. And, too, each wave produces other waves, which I often also follow.

Could these learning activities have been strung together like this by prior planning? Never. It all results from doing my own driving, making (real time) decisions at various points and acting on them.

Praxeology in Action

The science that deals with this, with the theories of action and choice, is praxeology. Ludwig von Mises (1966) outlines its scope and nature:

> The general theory of choice and preference . . . . is much more than merely a theory of the "economic side" of human endeavors and of man's striving for commodities and an improvement in his material well-being. It is the science of every kind of human action. Choosing determines all human decisions. In making his choice man chooses not only between various material things and services. All human values are offered for option. All ends

> and all means, both material and ideal . . . are ranged in a single row and subjected to a decision which picks one thing and sets aside another. Nothing that men aim at or want to avoid remains outside of this arrangement into a unique scale of gradation and preference. . . . No treatment of economic problems proper can avoid starting from acts of choice; economics becomes a part, although the hitherto best elaborated part, of a more universal science, praxeology. (p. 3)

All activities involving learning would also fall within the scope of this universal science of human action. (16)

Just as chaos is a science that touches all sciences, praxeology is a science that touches all human activity, all fields that deal with it.

As previously noted, Mises (1966) saw that there was no such thing as an "economic side" and a "non-economic side" of human life, operating under different laws, and that therefore, "The teachings of praxeology and economics are valid for every human action without regard to its underlying motives, causes, and goals." (p. 21)

William Schubert (1984), who did an exhaustive study of curriculum books published this century, came to similar conclusions about the proper scope of curriculum. He suggested "applying curriculum inquiry to the wider domain from which it has grown, i.e., to a holistic concern for the

journey from birth to adulthood." (p. 346) He goes on to say:

> Quite obviously, homes, peer groups, formal youth organizations, jobs, and media profoundly affect children and youth. I submit that these are curricula in their own right and should be studied as such by curriculum scholars.
>
> Compared to the cumulative effect of these non-school curricula, the impact of school curriculum itself is dwarfed. It is doubtful that curriculum can be studied meaningfully today apart from full attention to the interdependent character of life's curricula. (p. 347) (17)

Learning is not a distinct activity apart from living -- we cannot separate life into "learning" and "non-learning" activities.

This expanded scope of both economics and curriculum means that there is a great deal of overlap in their areas of concern, that they have a lot in common -- within the broad scope of praxeology -- that what has been developed in economics (18) will likely be relevant to curriculum theory and vice versa. It means that the principles of economics -- economic (i.e., efficient) human action -- are quite pertinent to what goes on in the name of education.

The mere act of defining the basic act or action that

each field is concerned with shows this.

It has not been easy reaching a consensus in the field of education. Taba (1962) says that, "One . . . searches in vain for a fairly clear statement of what a learning act consists of." (p. 86) (Does it really matter then whether or not, or to what degree, an act involves learning?)

One attempt at an inclusive definition by Paul Maves (1951) says that:

> Education is creative inter-action between persons in which the needs of each are served and in which the experiences of the more mature are available as a resource for the less mature." (p. 273)

Note the reference to interaction and needs. This almost sounds like economics. (19)

For economics, Mises (1966) defines action generally as "an attempt to substitute a more satisfactory state of affairs for a less satisfactory one." (p. 97) -- and this could apply to education (before and after something is learned). William Schubert (1986) relates the basic curriculum question to what will "enable a person to live a good and fulfilling life" (p. viii) -- which sounds very much like attempting to reach a "satisfactory state of affairs," as in economics.

So in the end, what applies to human action generally, to praxeology, applies to learning.

This is shown too by the wide applicability of Maslow's hierarchy of needs. These needs range from basic survival needs up to self-actualization. (Maslow 1970, p. 39-46) Educators have applied them to teaching and learning situations. (Miller and Seller 1985, p. 125-27) But they really have a more direct link with economics, since the satisfaction of needs (of all types) is what occurs in economic transactions, in contractual actions between people.

Planning for Action

All this has a great impact on the concept of planning, if learning is accepted as a dynamic activity occurring in an interactive environment.

Cartwright (1991) says that, "chaos theory promises a revolution in planning at least as profound as that entailed in the current trend towards an information society." This, he says, is mainly because of

> the fact that chaotic systems are predictable on only an incremental or local basis . . . . a powerful argument for planning strategies that are incremental rather than comprehensive in scope and that rely on a capacity for adaptation rather than on blueprints of results. (p. 54)

This is what Karl Popper (1985) calls "piecemeal social

engineering" -- consisting of "small adjustments and re-adjustments" -- in contrast to "a definite plan or blueprint." (p. 309) "Of these two doctrines," he says, "I hold that the one is true, while the other is false and liable to lead to mistakes which are both avoidable and grave." (p. 311) (20)

This has rather profound implications for curriculum. And it concurs with what Zvi Lamm (1976) said:

> The teacher who knows in advance what action he will take during the course of the lesson is actually less well prepared than the teacher whose preparation is not so specific. (p. 225)

There are planning concepts that involve developing strategies for interactive situations -- one of which is the game plan. There is a fundamental difference between this and following a step-by-step pre-set curriculum -- which Kid Jackson's manager (see Figure 2) fails to realize. A game plan is (or should be) very much reactive and adaptive. Game can be taken in a broader concept than just a competitive event, and could include informal interactive learning games that kids phase through as they grow up (see Holt 1989). The business plan is a similar interactive concept, although it deals with longer time spans. Both involve real-time decision making and are an amalgam of short term planning and less specific long-term planning --

all of which is subject to constant review and revision. We need a life-plan concept like this for curriculum to relate to.

Cartwright (1991) also says that, "Planning for chaotic systems may be more successful when it is viewed as a succession of judicious 'nudges' rather than as a step-by-step recipe." (p. 54) I give my steering wheel judicious nudges when I drive my car. These nudges, or piecemeal adjustments, require real-time decision making, whereas a step-by-step recipe (or pre-set curriculum) for the most part avoids it. And without it I may find myself running without the ball, or punching an opponent that isn't there, or hitting the side of a garage with my car -- or lecturing to students who fail to get my meaning or message.

Is this saying that the idea of long-range planning and goals should be abandoned? Not at all. I can still aim for a garage from 500 miles away -- with my own car. But how can I manage to do this with a whole bunch of other cars, unless I load them onto tandem trailer transport trucks, or hook chains on them, and then drive them all together in the same direction (i.e., the brute force method)? And in doing so, don't I strip each driver, each car, of its individual drive? Isn't the "chaotic city" preferable to such a scenario? I cannot be planning for all these cars, except in a general way, by just having roads and other facilities available, in anticipating their needs.

This "incremental and adaptive" tactic applies, really,

to planning for all types of activity, from no control (weather forecasting) to supposedly total control (totalitarianism). Of course no "totalitarian" regime has either the measuring or mental capacity to run every last aspect of an interactive system, to totally suppress the butterfly effect. But if you are omnipotent (and good at differential equations) you do not need to go that far. Einstein said that God doesn't play with dice, which is probably true. He just needs to play with butterflies. The irony of it all is that, being omnipotent, you do not need brute force, just butterflies.

The mechanism, then, for maximum satisfaction of wants and needs, by the most efficient means, is the actions, the selections, of individuals pursuing their interests. And the medium for this is the marketplace, in all its many forms, where people interact.

The competition for selection in the marketplace (survival of the finest) tends to produce evolutionary changes in whatever it handles. The many interactions in effect generate a sense of direction, a wave front. Any entities that cannot or will not adapt go down the tubes. (Perhaps ages from now social paleontologists will wonder why, like the dinosaurs, so many communist governments bit the dust in such a short span of time.)

Any efforts that work against free-market forces require the expenditure of energy, and thus money, and as a

result reduce overall efficiency, while any attendant limits restricting the available choices reduce the maximum effect produced.

Likewise, in education, any efforts that counter natural curiosity and interest, where and when they occur, reduce educational efficiency, at an added cost, besides. It is essential, for optimal learning, to let free-learning forces operate.

The Learning Algorithm

In the marketplace it is not always easy to determine trends. But with learning when students pursuing their interests are free to act they set the trend. You just need to let it flow, to recognize the flow and not impede it. John Dewey (1975) said that, "At bottom all misconceptions of interest, whether in practice or in theory, come from ignoring or excluding its moving, developing nature." (p. 90-91) Let the students ride their waves (carpe diem). Learning how to ride the waves is learning how to learn. (Students do a time-flip each year, from the chronos and curriculum of the school year to the kairos of summer -- an "endless summer" of riding waves. We need to bring kairos into school curricula.)

This is the real key to sequencing. The sense of next-ness, of readiness, is reflected in the present question being asked, or the present sense of wonder. Lacking differential equations to provide us with

moment-to-moment guidance in a chaotic world, this is the best test of moment readiness that we have. John Holt (1988) says:

> We cannot know, at any moment, what particular bit of knowledge or understanding a child needs most . . . . Only he can do this. He may not do it very well, but he can do it a hundred times better than we can. (p. 294)

This is the kind of scenario that needs to be encouraged and nurtured, that can lead to rapid unnumbered successions of meaningful teachable moments.

Student questions and wonder are a prime driving (and steering) force -- the fuel, the essential ingredient in learning how to learn. They should be given top priority when they occur, allowing students to determine their own direction of learning, to form direct links from questions to action. We need to encourage self-perpetuated crash learning (SPCL) when it occurs, to let it run its course. Any actions we take that tend to suppress questions are counterproductive, and reduce optimal learning and efficiency. In fact students that have stopped asking questions are really dysfunctional, and in need of remedial learning. They are like cars that no longer go.

And if, in the marketplace, the customer is never wrong, how can we ever say that the student is wrong. If

anything this should be even more true in the case of the student, because of one simple fact. Trial and error are great teachers -- they produce learning.

The link from questions to action is also an essential part of critical praxis and the resultant concept of emancipatory curricula, which stress seeking liberation from oppression and social injustice. (21) There is politics involved in such emancipatory interests of course, just as there is in the free market vs. central planning. One could say that critical praxis was (and is) at work in eastern Europe and the former Soviet Union.

Models and Metaphors

The praxeological pattern of repeatedly being faced with making choices is like being faced with a succession of menus to choose from -- which might seem to fit the multiple branching of programmed learning. But suppose, while I am at the computer going through one of these, I slip (via a modem) into a database I would like to search. Here I am also presented with a succession of menus. The two though are apparently designed from different perspectives. Yet both the database and programmed learning provide branching and attempt to acommodate the learner at each stage. What is the essential difference?

In programmed learning, despite the branching, there is an overall sequential flow, a presumed sequence, that tends to converge at the end, whereas in databases there is no

such flow. They are just there to be used. In fact there is no real end either -- they are open-ended. In programmed learning there are pre-determined paths and branchings, with a pre-determined sense of next-ness all along the way, with no possibility of SDIC ever developing. Most do not even allow regressions to previous menus and screens, or allow questions to be asked. Databases on the other hand have no such sense of next-ness, except on a short-term basis waiting input. The actual paths taken are not selections from a pre-determined set.

A well-designed database has screen prompts at each stage that are essentially self-sufficient, and also "help" messages that anticipate possible problems and difficulties at various stages. There are also pointers to related or more detailed material. And so the model of a well-designed database is this: a body or accumulation of information, knowledge, and so forth, that is spiced with sequential strains, to allow ease of access and use. Databases allows random access, whereas programmed learning does not. The former is geared for inquiry, while the latter is geared for presenting information and accepting answers.

But databases go beyond the realm of computers. So much of the world, what there is to learn in it, is in the form of databases. An encyclopedia is a database. And so is a library and its catalog, as is a science center or a nature preserve. Any language is also a database. (How should we sequence the learning of a first language? a

Figure 4

Where do I begin?

BEST COPY AVAILABLE

second language?) A person is very much like a database too. All of these are clusters from which knowledge is to be gained, and for which pre-determined sequencing makes no sense.

Can you imagine mainstreaming the patrons of a library, or a video rental place, or a supermarket, running the patrons of each through predetermined sequences? (Figure 4) (Could it be done without compulsion?) You can browse in libraries, supermarkets, and video stores, and in searching databases. You can even browse, in effect, with a person, during an informal get-together. And you can browse at parties, unless they are showing home movies. But can you browse during a typical history or math class?

But in particular, libraries, museums, science centers, and even video rental places, are all learning centers. This should not be overlooked.

Perhaps the curriculum field should concern itself with optimal algorithms for accessing databases along with database design, as a major area of investigation.

Among other models that might be useful for curriculum (beyond spirals and simplistic plots of chaos) the tree model is extremely adaptable -- in particular the concept of a growing tree that continues to produce branchings in fractal fashion (i.e., branches on branches on branches . . .). For one thing, it is non-linear, like the real world -- not amenable to linear sequencing. It is also open-ended.

And in many ways it represents how knowledge develops, how it is assimilated -- how ever finer distinctions are made, in fractal fashion, as knowledge expands.

At an early age, for instance, any four-legged animal standing in a field might be called a cow. (Holt 1989, p. 86-87) But as we grow we learn to make distinctions among the different animals -- our knowledge tree develops more and more branchings.

There is a well-known ANIMAL computer program that works in just this way, continuing to expand its tree of knowledge as it is used. It starts out thus: (Friendly 1988, p. 238-41)

THINK OF AN ANIMAL. I WILL TRY TO GUESS IT BY
ASKING QUESTIONS.
DOES IT HAVE LEGS?
.
.
.

It keeps asking yes/no questions until it reaches the end of a branch in its knowledge tree, at which point it makes a guess:

IS IT A COW?

If the guess is wrong it responds:

TOO BAD! I WAS WRONG. WHAT ANIMAL WERE YOU THINKING OF?

And after the new animal name is typed in (such as HORSE) it says:

PLEASE TYPE IN A QUESTION WHOSE ANSWER IS YES FOR A HORSE AND NO FOR A COW.

The old branch-end becomes a new branching, to either HORSE or COW. This branching process can go on, the knowledge tree can keep expanding indefinitely. (22)

What is the algorithm here? It is question-asking by the learner. The program (learner) treats the user like a database and keeps asking it/him/her questions. No questions, no learning -- you cannot make it learn by injecting knowledge into it. The only way it can assimilate knowledge is by asking questions until it makes a mistake. It never learns anything without first making a mistake (which becomes a teachable moment). And as long as it has power, and is not turned off, it will keep learning and learning and learning . . . How could we possibly sequence such a scenario ahead of time, including the required mistakes?

The various factors here -- question-asking, knowledge and learning trees, turning students off, and database

access -- need to be major concerns in the curriculum field.

The tree model also supports the concept of learners as creators of knowledge. They each, in the process of learning, build their own individual knowledge trees -- nobody can do it for them. Nobody can possibly have the knowledge or perspective needed to add to or modify another person's tree.

A major concern associated with curriculum is that of coverage. But that too is covered by the tree model and its pattern of fractal branching. Very little sunlight gets through a fully developed tree. And fractal branching matches the real world better than linear sequencing does.

The wave model is also useful in this regard. Any wave motion tends to fill any area it is propagated in, like dropping a stone in a pond, no matter what its shape. Huygens' principle of wave motion states that any point on a wave front can serve as a propagation point for further wave motion -- which is the ultimate in fractal branching. It is like saying that any point on a tree can be a node for new branching.

Media Models

Another useful concept for curriculum is the magazine model, particularly magazines for hobbies or other activities -- where there is a range of readership, say, from novice to advanced. The magazine though does not really take its readership anywhere according to some

sequence, becoming more and more advanced with each issue (23) -- the way a curriculum typically takes students through a subject. The readership is more or less constant, and any given issue will most likely have material for the whole range of its readership. Like the spiral curriculum it returns to the same topics from time to time. But it only does so when the time seems right, not according to some pre-set plan. (24) And the readers just pick out what interests them, among the magazine's offerings.

There are significant differences between this and the traditional curriculum format. And yet such magazines can be great learning vehicles -- almost indispensible in some cases if you want to learn about a new hobby or field.

The newspaper format is another useful concept. When there is a major event, such as the Superbowl, the coverage of it consists of a variety of short and long pieces from all different angles, covering different aspects and topics from the particular to the general, along with commentary. Coverage of the event is quite thorough. And yet no attempt is made to fit it all into a single sequence (a fairly impossible task). Indeed, attempts to do it would lessen coverage. How much coverage is provided by a tree consisting mainly or only of a trunk? (25)

If we are concerned about curriculum coverage of a subject perhaps we should look at these magazine and newspaper models, (26) and to the lesson they convey, that

sequencing interferes with full coverage. The sequencing should occur at the point of learning.

Logic and Learning

Mises (1966) has repeatedly made the point that the statements and propositions of praxeology cannot be verified by experiment, as with physics and other sciences, that they can only be deduced. "They are, like those of logic and mathematics, a priori." (p. 32) That is because, "Like logic and mathematics, praxeological knowledge is in us; it does not come from without." (p. 64) How much of this applies to learning as a human activity? How much just needs to be deduced logically from basic axioms?

Popper (1968) also maintains that knowledge grows by logical deductions from theories, which cannot be proved. But these are not a priori, (as in the case of logic and mathematics), existing only in the human mind. The theories Popper deals with are of empirical science, which he says can only disproved and replaced with better theories. How much of this applies to learning and the activities associated with it?

In any case, how many educational studies recognize either perspective?

Logic and Planning

If you favor students being active participants in their own learning, how can you logically support the idea

of using fixed plans prepared in advance, applicable to all students, as the best way for each of them to learn? Chaos theory alone shows this to be impossible.

This is the planning perspective that doomed the Soviet Union. Advanced planning and directing of other people's time, other people's lives, will always lead to inefficiency and waste.

There are dire implications in this for planning in education. We need to see the handwriting on the wall. We need to give the Soviet collapse a name -- like Sputternik -- so that it will be a constant reminder to us, of where we are headed, of the danger and the waste of our resources if we continue to suppress and ignore free-learning forces in the name of education. The major problem is our whole perspective on planning. We are not in Camelot.

In the movie Rebel Without a Cause, Jim (James Dean) after a confrontation with the gang leader Buzz (Corey Allen), agrees to take part in a chickie run, on a bluff overlooking the ocean, in which the first one to bail out as each drives a car toward the edge, is a chicken.

While standing at the edge before the run, looking down where the cars will wind up, they exchange thoughts after beginning to break through their bravado:

Buzz: That's the edge...That's the end.

Jim: Yeah...certainly is.

Buzz: Know something...I like you...y'know that?

Jim: Why do we do this?

Buzz: Ya gotta do something, now don't ya?

(Weisbart and Ray, 1955)

"Dumb kids, and their rituals," you might say. In spite of the changing situation they still need some action -- "We gotta do something."

But if we react like this we miss the reality of how pervasive this imperative is, in all sectors of society, especially in the curriculum profession -- and especially in organizations.

The League of Women Voters, for example, was formed in 1920 (the year women got the vote) in order to help make them more well-informed as voters. But as the years went by these services were no longer needed, the way they once were. Likewise, the March of Dimes, which used to concentrate on fighting polio, was left without a cause when polio was conquered.

How does an organization without a cause react, when their founding problem no longer exists? Do they happily close up shop and go home, like Jim and Buzz could have done? No. They say in effect, "We gotta do something," and after looking around for something else, redefine what they are about.

This imperative particularly infects planning, often resulting in over-planning, planning from the planner's

perspective -- with heavy reliance on lectures, movies, and other presentations -- i.e., the home movie syndrome. We need to avoid this kind of perspective in our planning -- even if it means redefining what we are doing -- or after a while nobody will come to our parties, nobody will accept our services, unless we force them to. But even that imperative will run out, eventually.

Conclusion

If learning is conceded to be dynamic and interactive, chaos theory alone shows that we need to deal with the whole person -- and a whole lot more, even to electrons at the edge of the galaxy.

This is an impossible situation of course, and the best way we have to deal with it, to proceed from moment to moment, is by allowing the real-time perspectives and decisions by the learner to become operative -- in a free-learning environment, in learning venues with plenty of available resources.

This need to focus on the whole person means that curriculum theory that deals only with planned learning, that fails to take into account outside and incidental learning, as well as learner activities and attitudes in general, can be dismissed as inadequate.

Among the things that can be deduced from this are that central curriculum planning is inappropriate, and that each learner has different optimal learning paths -- which need

to be determined ultimately, with real-time decision making, by the learner. A student-centered focus does not mean finding where each student is and then leading them to the Yellow Brick Road, but rather helping them, from where they are, to build or find their own road.

Also, SDIC means that the milieu can have a significant effect on learners and their paths of learning, while attention-grabbing and mind-engaging material can string together many reachable moments. But the choice still needs to be the learner's -- we need to avoid the home movie syndrome, even when we have good movies.

We also need to look at databases (in all their forms) as learning resources, and to improving learner access to them via indexing and other means.

And this means, too, that practically speaking, a curriculum (like a weather system) has no beginning and no end. If the students do the driving, ride their own waves, we are (or should be) at best only part-time hitchhikers. Their journey began long before we meet them, and continues on long after we (they) leave. We deceive ourselves if we think we can lead them in learning. By the time we first pick up a student's path it is already too late. But we too, like Gatsby, believe in the green light that keeps receding before us, against the current. (Fitzgerald 1925, p. 182) And so we row recursively, back into the past -- grasping for some rationale we never really had.

All this, of course, affects the whole concept of class and classroom. (Are learners passive objects to be classified?) The only classifying we might need to do is for the dysfunctional, to help them get going. Any mass routine classifying flirts with the home movie syndrome.

This does not mean that learning would become an individualistic, non-group activity. In any informal social setting groups of various sizes form and dissipate in chaotic fashion. What causes these groups to form is some interest which the group members (for the moment at least) have in common. All this is really a marketplace, where people are free to make choices. And the groups that form are interest groups, or more specifically, special interest groups -- SIGs. These are the kinds of groupings we need to encourage. (27) These are the paradigms we need -- the SIG and learning venues, rather than the classroom and class.

We need new terminology here. What do we call learning's counterpart to the game plan/life plan concept? Is "praxis" specific enough? I suppose that this too could be called "curriculum" -- in this field of chameleon terminology. (Isn't it time to put an end to this sort of thing?)

But there is a more basic question. Where should learning rate with quality of life? Where should our main concerns be?

The professor asks, "What did you learn in life today,

dear little son of mine?"

"I saw Casablanca for the fourteenth time, then wined and dined an old friend of mine."

"But what did you learn, did you experience anything new?" (28)

Would we expect the professor to be concerned only with the learning part of life -- with only the incidental learning involved in the experiences of living? What about concern for happiness, quality of life -- the aesthetic dimension?

What if, on hearing the Beethoven Ninth for the hundredth time ("Play it again, Sam"), someone asks, "What did you learn?" -- and you say, "Nothing really, I was just greatly moved, as usual." Or what if someone says, "We made love for the hundredth time -- it was beautiful." How do you respond?

What do we say about quality time spent with good friends and good wine? And what about the kairos of summer -- seasons in the sun, summer reruns on the beach? Do we applaud good living, or only learning? And if the latter, how can we say we have concern for the whole child?

Quality learning is often part of quality living, although we never know in advance where or when, or what it will be. Any given time spent with a friend (or his spouse) can unexpectedly and unpredictably involve a great deal of learning. Any given summer can suddenly be special. How much learning took place during The Summer of '42 (Raucher

1971), and how long did it last?

What should the professor then wish his son? ("I wish you good things, Hermie, only good things.") Do we wish our children only good times -- or rather the kind of living that leads to learning? If we lean toward learning, we might wish them tragedy and suffering, since these tend to produce real learning. Or maybe (feeling compassion) we could just wish them bittersweet times, poignant moments -- for the sake of learning. We could also wish them mistakes, since they learn from these too. What kind of wishing is all this? Don't we really just wish them meaningful lives? And if we do, then we need to see their learning as meaning making, and adjust our thinking to this.

We are treading on dangerous ground though, if we opt for this. Do we expand the kairos of summer, for the sake of learning -- extending vacation to spring and fall? Or do we in various ways transform our schools into places for living, into resources for finding meaning? We need to re-direct our focus, to think in terms of learning venues, libraries, and SIGs. These are drastic changes, but they are needed. We need to see the Sputternik handwriting on the wall.

But what about having a mix of both prescribed and free learning, with the idea of capturing the best features of both? Mises (1966) showed that in a mixed system, operated

without compulsion, publicly run enterprises are still subject to "the law of the market" (p. 258-59) -- since they need to get their equipment and supplies in the marketplace, at market prices, and then compete in the market against other service providers. But if schools compete against free learning, it becomes like mass transit trying to compete against the automobile.

If you bring compulsión and regulation into the picture though, the situation gets even worse, with the effect being the opposite of what was intended. (See Mises 1966, p. 763-64.) The values established in a free market, through a meeting of minds, tend to equalize supply and demand, and to allocate resources efficiently to where they are most needed. Any regulatory intervention that disturbs the market, however, disturbs this meeting of minds, with either supply or demand drying up, along with the resultant market transactions the regulatory action attempted to promote. And then even more regulation is needed to try to salvage the attempt and restore the ecological balance that was disturbed -- all without the mathematical tools, the differential equations and such, (29) needed to accomplish the task, and with unseen butterflies all around.

The case with learning is no different. With regulated learning too, you lose this meeting of minds, with a resultant loss of efficiency. And as in economics, the effect of compulsion is generally the opposite of that intended, and for the same reason -- the learning drive

(demand) dries up in students, and various learning dysfunctions show up -- with yet more intervention needed to try to correct them. John Holt (1988) gives several examples of such unintended negative effects, in the case of schooling. See also Jackson (1991, p. 8-9) -- "Unwanted Outcomes of Schooling Perceived as Curricular."

You could also point to current and past literacy rates, as well as to anxieties in various subject fields like math and physics, as examples of unintended negative effects.

Thus no mixed mode of prescribed and free learning can work as well as when students are free to pursue their concerns and interests. This too is one of the lessons of Sputternik.

To say that curriculum is a field which lacks logical form or foundation is not entirely true. One only has to look at what has been developed in recent years from Habermas' theories on knowledge and critical social science, for evidence of this. (30) In fact what may be most lacking in logical development and consistency are attempts to defend the status quo, business as usual.

Education, like economics, suffers from multifarious definitions and perceptions, (31) due largely to piece-of-the-pie pluralism. We need to refine and redefine the field -- to purge it of this pluralism. That alone would improve the theory-to-noise ratio, and make the field

more respectable.

If the field's boundaries seem loose and amorphous, that should be no real concern, if we are developing solid theory. It might be an indication that its scope is even broader that we imagined -- like finding that the law of gravity has wider applicability than originally believed.

Are we near that stage, of reaching another plateau?

There are obvious commonalities between the critical theorems of Habermas, which are "implicit in the very nature of human interaction" (Grundy 1987, p. 112), and the praxeology (basis for all human action) developed by Mises. And much of this relates to the work of Popper and Kuhn on growth of knowledge, as well as Hayek and others.

The work of each could be analyzed and assimilated, as part of extending these logical developments into a more coherent, meaningful, and practical body of knowledge for educators in all venues of learning -- which is certainly something for curriculum professors to do.

Postscript

Philip Jackson (1991), among others, has expressed doubts about the future of the field, making such comments as "Perhaps . . . there is no longer the need for the services of curriculum specialists that there once was." (p. 37) No need??? With schools in such dire need of help? Who is giving them the help they need? The key to marketing is to find a need and fill it. How are curriculum

specialists marketing their services to fill these needs? Are they really focusing on client needs, as we all should focus on student needs? Railroads failed to focus on needs, failed to adapt -- not realizing that they were after all in the transportation business. Libraries, to some extent, have adapted -- realizing that they were in the information (not just the book) business. What business are curriculum specialists in?

Organizations without a cause often do survive -- if they can adapt to the law of the market.

This too is one of the lessons of Sputternik.

Notes

1. not counting those of organizations, like AERA and ASCD.
2. VCR recording (of live TV) and various levels of cable service are two additional means of increasing the options available, of time-scheduling and programming choices, which people are also willing to pay for.
3. Schools and classrooms though have a custodial (day-care) function as well as a curricular one.
4. Note: In some cases the planning of what and when are just offerings that people can take or leave. In others they are inherently part of management that preempts people's choices, and can involve either pre-packaged plans to be followed or real-time regulation of some controlling factors.
5. This is discussed in Adam Smith's An Inquiry into the Nature and Causes of the Wealth of Nations [1776], as well as other writings since.
6. Skousen (1991) analyses economic success and failure in various nations and how this correlates with central planning and regulation. (See especially chapters 16 and 17.) Forbes (1991) also presents many of these examples.
7. although the GNP fails to take into account both the underground economy (which in some ways is analogous to the hidden curriculum) and the various stages of production in an economy. See Skousen (1991), p. 32-46.
8. There have been extensive studies though that have shown

significant gains in a free-learning environment for such things as reading and math achievement, and IQ scores. See Rogers (1983, p. 197-224): "Researching Person-centered Issues."

9. The problem is to determine the positions at any point in time of 3 bodies in space with arbitrarily assigned masses and initial positions and velocities.

One may have gotten a first impression in school that this problem remains to be solved, learning only later that it is apparently unsolvable -- yet with still an aura of mystery about it all.

Really though, the whole matter can be dealt with in a simple and direct manner.

If we were going to solve the problem, what types of functions would we need? Well, all we need are functions that in general are bounded, non-periodic, and non-asymptotic.

It would just be a matter of finding functions that meet these three criteria. But can you think of any?

* * *

Note: the bounded condition merely assumes that the 3 bodies remain within each other's gravitational fields, that none achieves escape velocity. And solutions would only be periodic in special cases. Also, an asymptotic solution would mean gradually lapsing into a steady state, which would not be true, generallly speaking, for 3-body problems.

There is a condition that is weaker than asymptotic -- that for some (rather than all) values of a path parameter greater than a given value, the path will be closer to the steady state than it was for the given value. This condition would allow the path to approach arbitrarily close to two or more steady states, in flip-flop fashion -- which would fit chaotic motion between two or more "strange attractors."

These characteristic patterns with strange attractors can of course be ascribed by infinite polynomials. But how do we assign the coefficients?

10. For the story of chaos and how it developed as a science see Gleick (1987).

11. Does carpe diem apply to the teacher, or the students?

12. This does not deal with the matter of cause and effect (what causes what), or of whether or not teachable moments exist apart from or prior to attempts at matching, or (directly) with the matter of maximum learning -- or with learner factors, such as the vigor with which interests are pursued.

13. The equations:

$$dx/dt = 10(y - x)$$

$$dy/dt = xz + 28x - y$$

$$dz/dt = xy - (8/3)z$$

are discussed in Stewart (1989, p. 136-38) and also Gleick (1987, p. 323).

14. If you want to try the memory excercize with Annie Hall,

you can check your scene-by-scene recollections fairly quickly using Leff (1983, p. 13-17).

15. The term "chaotic classroom" though is really something of an oxymoron, when one considers what classroom really means and its analogy with the bus. Perhaps "chaotic learning environment" would be a better, and more general, term.

16. There are a couple of works on curriculum that do bring praxeology into their discussions. One, called "Praxeology and Curriculum" (Iwanska 1979), unfortunately restricts its focus to the making of curriculum before-hand rather than to actual learning. Another one, "A Discipline of Curriculum Theory" (Mann 1975), uses praxeology more or less as a synonym for action lacking a theoretical basis -- clearly not referring to it as the science of human action. The issues dealt with are quite different.

17. This concurs with the view of Mises (1966, p. 877-78).

18. real economics, not the politically expedient kind behind pronouncements by politicians and bureaucrats.

19. The definition does not include autonomous learning, in which a person satisfies his own needs, but that can be accommodated.

20. In a note explaining that 'social engineering' does not imply centralized planning, and that he is in agreement with Hayek on its shortcomings, Popper (1985) adds, "You cannot centralize within a planning authority the

knowledge relevant for such tasks as the satisfaction of personal needs . . ." (p. 440).

21. based on the work of Paolo Freire, Jurgens Habermas, and others. See Grundy (1987) for more background.

22. This is really the same process described by Popper (1974, p. 256-267) in "Evolution and the Tree of Knowledge," He says,

> The process of discovery or of learning about the world . . . may be said to be <u>evocative</u> rather than <u>instructive</u>. . . . We learn about our environment not through being instructed by it, but through being challenged by it: our responses . . . are evoked by it, and . . . <u>we learn from our mistakes</u>." (p. 266)

This process of a learner making finer and finer distinctions among animals in tree-like fashion simulates the evolutionary process of speciation in the animal world. The advance of knowledge in civilization also simulates this process. But that does not mean, as some have contended, that the way things are learned by the individual should replicate the way they were learned historically by civilization. Because of SDIC, the actual patterns could be quite different.

And besides, even in the simplistic ANIMAL program, the patterns do not involve simple add-on growth, but

rather replacement growth, where previous learnings are replaced by new ones -- further opportunity for SDIC to affect the process, particularly if the replacement process involves a paradigm shift (Kuhn 1970). Lamm (1976) captures the sense of uncertainty and chaos that can be involved in the process:

> The pupil applies existing strategies even in situations where the teacher seeks to promote alternate ones . . . . Instruction is neither a simple, cumulative activity nor a spiraling one. It is an activity accompanied by contradictory activities: the disrupting of existing behaviors and the structuring of new ones.
>
> The behavior learned is a function of the interaction between the learner and any given factor in his environment. (p. 63-64)

23. except for technical advances in the field itself.
24. except for seasonal slants.
25. How much coverage is provided by journal articles without any notes or parenthetical remarks?
26. The two models are complementary in time, the magazine model being longitudinal (over a span of time) and the newspaper model being latitudinal (at a given point in time).
27. This would include mixed groups -- mixed levels of mastery

-- as well as master-apprentice pairings.

28. A great deal, really. It was actually the old friend's wife, and some man that kept following him around and giving him advice sounded mysteriously like Humphrey Bogart.

29. Mises (1966, p. 710-15) also recognized that the idea of deriving and solving differential equations to deal with such situations was absurd and hopeless, even with computers.

30. See for example Grundy (1987) and Carr and Kemmis (1986).

31. There is an old quip about laying a hundred "economists" end to end, that could also apply to curriculum specialists (not necessarily for mass burial, though).

References

Briggs, Leslie J., ed. 1977. Instructional Design. Englewood Cliffs, NJ: Educational Technology Publications.

Carr, Wilfred and S. Kemmis. 1986. Becoming Critical: Education, Knowledge and Action Research. London: Falmer Press.

Cartwright, T. J. 1991. "Planning and Chaos Theory." Journal of the American Planning Association 57(1) (Winter): 44-56.

Crutchfield, James P., J. D. Farmer, N. H. Packard, and R. S. Shaw. 1986. "Chaos." Scientific American 255(6) (December): 46-57.

Dewey, John. 1975 [1913]. Interest and Effort in Education. Carbondale, IL: Southern Illinois University Press.

Ebert, Roger. 1988. Roger Ebert's Four Star Movie Guide. Wilton, CT: Amrein Marketing Associates.

Fitzgerald, F. Scott. 1953 [1925]. The Great Gatsby. New York: Charles Scribner's Sons.

Forbes, Malcolm S. Jr. 1991. "A New World Order . . . of Freedom." Imprimis 20(8) (August): 1-4. (also Forbes magazine 148(9) (Oct. 21): 21,350-55.)

Friendly, Michael. 1988. Advanced Logo. Hillsdale, NJ: Lawrence Erlbaum Associates.

Gleick, James. 1987. Chaos: Making a New Science. New York: Viking.

Goodlad, John I., and associates. 1979. Curriculum Inquiry: The Study of Curriculum Practice. New York: McGraw Hill.

Grundy, Shirley. 1987. Curriculum: Product or Praxis? London:

Falmer Press.

Hayek, Freidrich A. 1960 [1944]. The Road to Serfdom. Chicago: University of Chicago Press.

Holt, John. 1988. How Children Fail, rev. ed. New York: Dell.

Holt, John. 1989. How Children Learn, rev. ed. New York: Dell.

Iwanska, Alicja. 1979. "Praxiology and Curriculum." in John I. Goodlad and associates, Curriculum Inquiry: The Study of Curriculum Practice: 287-302. New York: McGraw Hill.

Jackson, Philip W. 1991. "Conceptions of Curriculum and Curriculum Specialists." in Handbook of Research on Curriculum. (Philip W. Jackson, ed.): 3-40. New York: Macmillan.

Joffe, Charles H. (Producer), and Allen, Woody (Director). 1977. Annie Hall [Film]. Santa Monica, CA: United Artists.

Kelly, A. V. 1989. The Curriculum: Theory and Practice, 3rd ed. London: Paul Chapman Publishing.

Kibler, R. J., D. J. Cegala, L. L. Barker, and D. T. Miles. 1974. Objectives for Instruction and Evaluation. Boston: Allyn and Bacon.

Kuhn, Thomas S. 1970. The Structure of Scientific Revolutions, 2nd ed. Chicago: University of Chicago Press.

Lamm, Zvi. 1976. Conflicting Theories of Instruction. Berkeley, CA: McCutchan.

Leff, L. J. 1983. Film Plots: Scene by Scene Narrative Outlines for Feature Film Study, vol. 1. Ann Arbor: Pierian Press.

Lerner, Alan Jay and Frederick Loewe. 1960. Camelot. New

York: Random House.

Mager, Robert F. 1962. Preparing Instructional Objectives. Palo Alto, CA: Fearon Publishers.

Mann, John Steven 1975. "A Discipline of Curriculum Theory." in Curriculum Theorizing: The Reconceptualists. (William Pinar, ed.): 149-64. Berkeley CA: McCutchan.

Maslow, Abraham. 1970. Motivation and Personality. New York: Harper and Row.

Maves, Paul. 1951. "Implications of the Findings of the Sciences of Man." Religious Education 46(5) (Sept.-Oct.): 271-79.

Miller, John P. and Wayne Seller. 1985. Curriculum: Perspectives and Practice. New York: Longman.

Mises, Ludwig von. 1966. Human Action, 3rd rev. ed. Chicago: Contemporary Books.

Ornstein, Allan C. and Francis P. Hunkins. 1988. Curriculum: Foundations, Principles, and Issues. Englewood Cliffs, NJ: Prentice Hall.

Peitgen, Heinz-Otto, and Peter H. Richter. 1986. The Beauty of Fractals. New York: Springer-Verlag.

Peverall, John (Producer), and Cimino, Michael (Director). 1978. The Deer Hunter [Film]. Los Angeles: EMI Films.

Poe, Edgar Allen. 1966. Complete Stories and Poems of Edgar Allen Poe. Garden City, NY: Doubleday.

Popper, Karl. 1968. The Logic of Scientific Discovery, 3rd ed. London: Hutchinson.

Popper, Karl. 1974. Objective Knowledge: An Evolutionary Approach. Oxford: Clarendon Press.

Popper, Karl. 1985. Popper Selections. (David Miller, ed.) Princeton, NJ: Princeton University Press.

Raucher, Herman. 1971. The Summer of '42. New York: G. P. Putnam's Sons.

Richard, Martin and Stanley O'Toole (Producers), and Schaffner, Franklin J. (Director). 1978. The Boys from Brazil [Film]. Beverly Hills, CA: Twentieth Century Fox.

Rogers, Carl. 1983. Freedom to Learn for the 80's. Columbus, OH: Charles E. Merrill.

Schubert, William H. 1984. Curriculum Books: The First Eighty Years. Lanham, MD: University Press of America.

Schubert, William H. 1986. Curriculum: Perspective, Paradigm, and Possibility. New York: Macmillan.

Schwab, Joseph J. 1970. The Practical: A Language for Curriculum. Washington, DC: National Education Association.

Skousen, Mark. 1991. Economics on Trial: Lies, Myths, and Realities. Homewood, IL: Business One Irwin.

Smith, Adam. 1937 [1776]. An Inquiry into the Nature and Causes of the Wealth of Nations. New York: The Modern Library.

Smith, Adam. 1982 [1759]. The Theory of Moral Sentiments. Indianapolis: Liberty Press.

Stewart, Ian. 1989. Does God Play with Dice?: The Mathematics of Chaos. Oxford: Basil Blackwell.

Taba, Hilda. 1962. Curriculum Development: Theory and Practice. New York: Harcourt, Brace and World.

Tenenbaum, Samuel. 1969. "Carl R. Rogers and Non-Directive Teaching." in William F. O''Neill. Selected Educational Heresies: 212-22. Glenview, IL: Scott, Foresman.

Tomlinson, Kenneth Y. 1991. "Freedom's Victory: What We Owe to Faith and the Free Market." Imprimis 20(12): 1-3.

Weber, Robert. 1963. [Cartoon]. The New Yorker 39(30) (Sept. 14): 159.

Weisbart, David (Producer), and Ray, Nicholas (Director). 1955. Rebel Without a Cause [Film]. Burbank, CA: Warner Brothers.

END

U.S. Dept. of Education

Office of Educational
Research and Improvement (OERI)

ERIC

Date Filmed
September 4, 1996